

PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Sequestration

02/2004



UPGRADING METHANE STREAMS WITH ULTRA-FAST TSA

Background

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Most natural gas streams are contaminated with other materials, such as hydrogen sulfide (H_2S), carbon dioxide (CO_2), and nitrogen. Effective processes for removal of H_2S and CO_2 exist, but because of its relative inertness, nitrogen removal is more difficult and expensive. This project will focus on the separation of nitrogen from methane, which is one of the most significant challenges in recovering low-purity methane streams. The approach is based on applying Velocys' modular microchannel process technology (MPT) to achieve ultra-fast thermal swing adsorption (TSA). MPT employs small process channels to greatly enhance heat and mass transfer. Enhanced heat transfer allows TSA cycle times of seconds compared to hours for conventional TSA systems and enables compact, economic systems for upgrading methane streams to pipeline quality.

Primary Project Goal

The primary goal of this project is to design and demonstrate a revolutionary approach to upgrading low-Btu methane streams from coal mines, landfills, and other sub-quality sources, based on applying Velocys' modular MPT to achieve ultra-fast TSA.

Objectives

This project is a two-phased effort. The objective of Phase I is to assess the technical and market feasibility of an microchannel process technology - based thermal swing adsorption (MPT-based TSA) approach for upgrading low-BTU methane streams. The three key tasks during Phase I are:

1. selecting an absorbent for use in a microchannel-based TSA unit
2. designing the MPT-based system and components
3. completing a process feasibility assessment

The objective of Phase II is to conduct bench-scale demonstration of Ultra-Fast TSA.



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PARTNERS

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D'Amico Technologies

COST

Total Project Value:
\$498,928

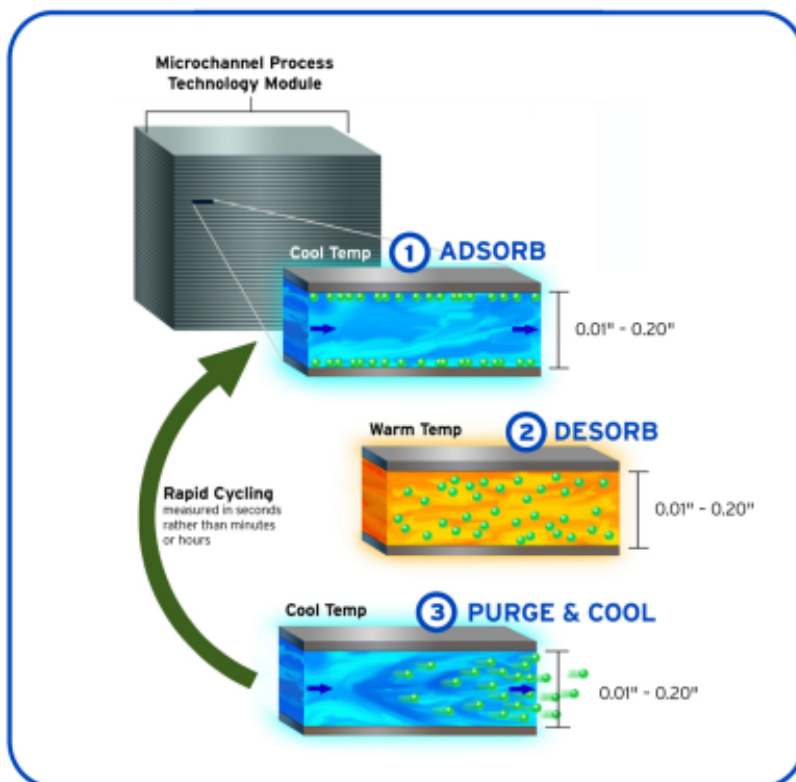
DOE/Non-DOE Share:
\$398,928 / \$100,000

Accomplishments

A one tier assessment of adsorbents, based on a literature search, has been completed and indicates that activated carbon looks promising. Preliminary tests have been initiated and include collecting methane and nitrogen capacity over several temperatures, compositions, and pressures. Planning for a conceptual system design has been initiated to guide the experimental test matrix.

Benefits

Successful completion of this project would enable recovery of methane from low-grade, previously uneconomic sources, such as coal mine ventilation gas and land fill gas. Because methane is a more powerful greenhouse gas than carbon dioxide, preventing methane emissions to the atmosphere is very important. Commercial deployment of this technology has the potential to reduce annual U.S. greenhouse gas emissions by 23.5 million tonnes of carbon dioxide equivalent while simultaneously recovering 3.5 trillion standard cubic feet of natural gas.



Conceptual scheme of the Ultra-Fast TSA process.